Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Redfish Lake Sockeye Salmon Captive Broodstock Program

Bonneville project number, if an ongoing project 9107200

Business name of agency, institution or organization requesting funding
Idaho Department of Fish and Game

Business acronym (if appropriate) IDFG

Proposal contact person or principal investigator:

Name	Paul A. Kline
Mailing Address	Idaho Dept. of Fish and Game, 1800 Trout Rd.
City, ST Zip	Eagle, ID, 81616
Phone	(208) 939-4114
Fax	(208) 939-2415
Email address	pkline@idfg.state.id.us

Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
NMFS 9204000	P.O. Box 130	Manchester, WA 98353	Tom Flagg
Shoshone-Bannock Tribes 9107100	P.O. Box 306	Fort Hall, ID 83203	Doug Taki
Univ. of Idaho 9009300	Univ. of Idaho	Moscow, ID 83843	Ernie Brannon
NMFS 8909600	2725 Montlake Blvd. East	Seattle, WA 98112	Robin Waples

NPPC Program Measure Number(s) which this project addresses.
7.4D Captive Brood Stocks, 7.4E Cryopreservation, 7.5A.1 Snake River Sockeye Salmon

NMFS Biological Opinion Number(s) which this project addresses.

Bio. Op. deals with jeopardy issues, not with recovery goals.

Other planning document references.

1) NMFS T.M# NMFS-NWFSC-2 Pacific Salmon and Artificial Propagation Under the Endangered Species Act. Numerous references to the utility of captive programs in recovery efforts. Reference to the development of comprehensive spawning matrices and the need for milt cryopreservation.
2) NMFS pre-decisional Snake River Salmon Recovery Plan. Chapter 3 - Numerical Escapement Goals - page 47. Chapter 7 - Artificial Propagation - pages 99 - 100.
3) NWPPC Return to the River - Chapter 8 Conclusion # 10 under Hatcheries - identifies hatchery programs for severely depressed stocks important sources of genetic information. Evaluations called for by the ISG are essential and active components of the IDFG sockeye salmon broodstock program.

Subbasin.

Upper Salmon River - Redfish Lake, Alturas Lake, Pettit Lake

Short description.

Establish captive broodstocks of Redfish Lake sockeye salmon. Spawn adults to produce future broodstocks, eggs, juveniles, and adults for supplementation. Monitor in-lake nursery populations and evaluate smolt outmigration by release strategy and broodstock lineage.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction		Watershed
	Resident fish		O & M	+	Biodiversity/genetics
	Wildlife	X	Production	+	Population dynamics
	Oceans/estuaries	+	Research		Ecosystems
	Climate	+	Monitoring/eval.		Flow/survival
	Other		Resource mgmt	+	Fish disease
			Planning/admin.	X	Supplementation
			Enforcement		Wildlife habitat enhancement/restoration
			Acquisitions		

Other keywords.

Captive broodstock, fish culture, fish health, outmigrant evaluations, spawner enumeration, lake carrying capacity.

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9204000	Redfish Lake Captive Broodstock Rearing and Research	Duplicate broodstock research and rearing by NMFS. Cooperative culture program contributing to the development of broodstocks for spawning and for supplementation to Stanley Basin lakes.
9107100	Snake River Sockeye Salmon Habitat Improvement	Cooperative program by the Shoshone-Bannock Tribes. Generates limnology and fish population data to guide supplementation efforts. Artificial fertilization program for three Stanley Basin nursery lakes to enhance recovery potential.
9009300	Genetic Analysis of Oncorhynchus nerka	University of Idaho mitochondrial DNA analysis of broodstock and wild sockeye salmon.
8909600	Genetic Monitoring & Evaluation of Snake River Salmon and Steelhead	NMFS protein gel electrophoretic analysis of broodstock and wild sockeye salmon.
9700100	Captive Rearing Initiative for Salmon River Chinook Salmon	Develops captive rearing strategies (at IDFG Eagle Fish Hatchery) for rearing juvenile chinook to sexually mature adults.
9305600	Assessment of Captive Broodstock Technology	NMFS effort to provide guidance for the refinement and use of captive broodstock technology for Pacific salmon.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Develop captive broodstocks from Redfish Lake anadromous sockeye salmon.	a	Develop the technology for captive broodstock propagation to meet program needs.
1		b	Trap returning anadromous adults, juvenile outmigrants, and residual sockeye salmon.
1		c	While in culture; quantify

			survival, maturation rates, age-at-maturity, sex ratio, and gamete quality of captive sockeye salmon.
1		d	Evaluate time held on chilled water (maturing adults) in relation to gamete quality, fertilization rates, and anomalies in broodstock progeny.
2	Maximize genetic diversity within captively-bread sockeye salmon broodstocks	a	Establish spawning matrices in consultation with NMFS and the program technical oversight committee.
2		b	Produce genetically defined progeny for use in multiple release strategies to Stanley Basin lakes.
2		c	Take samples for genetic analysis from all wild sockeye salmon incorporated in the program
3	Determine the efficacy of cryopreservation as a tool for meeting program goals.	a	Cryopreserve milt from specific wild and broodstock sockeye salmon.
3		b	Conduct fertilization trials using cryopreserved milt from captive broodstock adults.
3		c	Maintain cryopreserved archives at three locations to spread the risk of loss from catastrophic events.
3		d	Produce “designer broodstocks” from cryopreserved milt to broaden the genetic base in future brood years.
4	Describe *O. nerka* population characteristics for Stanley Basin lakes in relation to carrying capacity, supplementation efforts, and species recovery.	a	Estimate *O. nerka* population variables by mid-water trawl in four Stanley Basin lakes.
4		b	Trawl sufficient to estimate abundance and density by age-class.
4		c	Take scale and otolith samples from trawl captures for age and microchemistry analysis. Take tissue samples for genetic analysis. Take stomachs for diet analysis.

4		d	Monitor sport fisheries in Redfish Lake to determine their impact on recovery efforts.
5	Determine the contribution hatchery-produced sockeye salmon make toward recovery.	a	PIT tag wild Redfish Lake outmigrating smolts and hatchery-produced progeny for evaluation purposes.
5		b	Estimate *O. nerka* outmigration from Stanley Basin lakes.
5		c	Evaluate outmigration success by broodstock lineage and release strategy.
5		d	Examine travel time to lower Snake River hydropower projects and evaluate survival by broodstock lineage and release strategy.
5		e	Identify location, timing, and spawning success for maturing adult broodstock sockeye salmon released to Stanley Basin lakes to spawn volitionally
6	Refine our ability to discern the origin of wild and broodstock O. nerka to provide maximum effectiveness in their utilization within the broodstock program.	a	Continue otolith microchemistry analyses of *O. nerka* with known and unknown life histories.
6		b	Integrate microchemistry results with genetic information.
7	Technology transfer.	a	Participate in the technical oversight committee process.
7		b	Network with technical experts on issues related to culture and broodstock techniques, genetics, pathology and monitoring and evaluations.
7		c	Continue efforts to develop a program management plan.
7		d	Coordinate public information transfer with project cooperators.
7		e	Provide written activity reports to satisfy the needs and requirements of IDFG, the technical oversight committee, NMFS, and BPA.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	10/1998	09/1999	50.00%
2	10/1998	09/1999	9.00%
3	10/1998	09/1999	7.00%
4	08/1999	12/2000	6.00%
5	03/1999	09/1999	20.00%
6	10/1998	09/1999	3.00%
7	10/98	09/1999	5.00%
		TOTAL	100.00%

Schedule constraints.

No known constraints - Table above identifies fiscal year 1999 start/end dates.

Completion date.
The pre-decisional Snake River Salmon Recovery Plan identifies no end date for conservation programs of this type. Five generations of recovery time following substantive change in survival and adult escapement is suggested. If the 1999 decision point leads to a timely turn-around in survival, five generations would roughly come full term in the year 2024.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel		$207,000.00
Fringe benefits		$71,620.00
Supplies, materials, non-expendable property		$65,850.00
Operations & maintenance		$131,600.00
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$64,300.00
PIT tags	# of tags: 6000	$17,400.00
Travel	Includes all costs associated with travel, field per diem, and lodging.	$17,250.00
Indirect costs	21.3% of all costs except capital aquis.	$105,077.00
Subcontracts		$0.00
Other		$0.00

TOTAL		$680,097.00

Outyear costs

Outyear costs	**FY2000**	**FY01**	**FY02**	**FY03**
Total budget	$680,000.00	$680,000.00	$670,000.00	670,000.00
O&M as % of total	19.4%	19.4%	19.6%	19.6%

Section 6. Abstract

Precipitous declines in Snake River sockeye salmon populations lead to their Federal listing as endangered in 1991 (Redfish Lake ESU). The ultimate goal of Idaho Department of Fish and Game's (IDFG) captive broodstock development and research is to reestablish sockeye salmon runs to Stanley Basin waters and to provide for some degree of sport and treaty harvest opportunity. In the near term, our goal is to maintain Snake River sockeye salmon and prevent species extinction using captive broodstock technology. It is virtually certain that without the boost provided by this program, Redfish Lake sockeye salmon would soon be extinct. Captive broodstock efforts are consistent with the Recovery Goal presented in Chapter 7 of the National Marine Fisheries Service (NMFS) pre-decisional Snake River Salmon Recovery Plan and with the Council's Columbia River Basin Fish and Wildlife Program (7.4D, 7.4E, 7.5A.1).

Since the inception of the program in 1991, all returning anadromous adult sockeye salmon, several hundred Redfish Lake wild outmigrants, and several residual sockeye salmon adults have been captured and used to establish captive broodstocks at the IDFG Eagle Fish Hatchery and at NMFS facilities in Washington State. Adaptively managed, the program generates hatchery-produced eggs, juveniles, and adults for supplementation to Stanley Basin waters. Program captive broodstock techniques reflect the Regions best protocols for maintaining maximum genetic diversity, survival, and production success. Outmigrant evaluations and adult sonic telemetry studies provide a basis for determining whether broodstock lineage or release strategy are critical to the success of the supplementation program. Program methods and results undergo constant review and discussion through the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) process.

To date, approximately 30,000 juvenile outmigrants have emigrated from Stanley Basin nursery waters (through 1997 outmigration year). Hatchery-produced adults are expected to begin returning to the program in 1998. To balance natural escapement and hatchery production goals, a management plan is being prepared by SBSTOC participants. We anticipate the program continuing until successful natural spawning is established at sustainable levels adequate to achieve delisting criteria.

Section 7. Project description

a. Technical and/or scientific background.

Show how the proposed work is a logical component of an overall conceptual framework or model that integrated knowledge of the problem. The most significant previous work history related to the project, including work of key project personnel on any past or current work similar to the proposal, should be reviewed. All work should be adequately referenced and listed at the end of this field.

Numbers of Snake River sockeye salmon have declined dramatically in recent years. In Idaho, only the lakes of the upper Salmon River (Stanley Basin) remain as potential sources of production. Historically, five Stanley Basin lakes (Redfish, Alturas, Pettit, Stanley, and Yellow Belly) supported sockeye salmon (Bjornn et al. 1968; Chapman et al. 1990). Currently, only Redfish Lake receives a remnant anadromous run (Kline and Lamansky 1996). Historical accounts of sockeye salmon abundance in the Stanley Basin are scarce. In the late 1800's Everman (1895) made observations on the distribution and abundance of sockeye salmon in Stanley Basin lakes. Although not quantitatively described, Everman reported observing sockeye salmon in Redfish, Alturas, Pettit, and Stanley lakes. Between 1954 and 1966, a two-way weir was operated by IDFG on Redfish Lake Creek (Bjornn et al. 1968). During these years, adult sockeye salmon escapement ranged from a low of 11 fish in 1961 to a high of 4,361 fish in 1955. By 1962, sockeye salmon were no longer returning to Stanley and Pettit, and Yellow Belly lakes (Chapman et al. 1990). IDFG personnel operated the adult weir on Redfish Lake Creek between 1985 and 1987. In those years, 11, 29, and 14 adults were counted. Since the inception of recovery efforts in 1991, 15 and 0 adults, respectively, have returned to Redfish Lake Creek and to the upper Salmon River at the IDFG Sawtooth Fish Hatchery.

Waples (1991), described Snake River sockeye salmon as a prime example of a species on the threshold of extinction. In December 1991, NMFS listed Snake River sockeye salmon as Endangered under the Endangered Species Act (ESA). The ESA recognizes that conservation of listed species may be facilitated by artificial means while factors impeding population recovery persist (Hard et al. 1992). Often, the only reasonable avenue to build populations quickly enough to avoid extinction is through captive broodstock technology (Flagg et al. 1995). IDFG and NMFS initiated captive broodstock recovery efforts in 1991. Consistent with the Council’s Fish and Wildlife Program (FWP) and the NMFS1997 pre-decisional Snake River Salmon Recovery Plan, these efforts focus on protecting and rebuilding the last known remnants of the population. The project mitigates losses in place and in kind.

Coordination of recovery efforts is carried out under the guidance of the Stanley Basin Technical Oversight Committee (SBSTOC), a team of technical experts representing the agencies involved in the recovery and management of Snake River sockeye salmon. Further coordination takes place at the Federal level through the ESA Section 10 permitting process.

b. Proposal objectives.

Objective 1. Develop captive broodstocks from Redfish Lake anadromous sockeye salmon.

Hypothesis: Survival, maturation, age-at-maturity, sex ratio, and gamete quality will not differ significantly among genetically distinct broodstocks.

Assumptions: Fish culture practices among groups and between brood years will be similar and not affect outcomes.

Hypothesis: Rearing water temperature can be used to improve maturation rate, gamete quality, fertilization rate and lessen the incidence of congenital anomalies.

Assumptions: Fish culture practices among groups and between brood years will be similar and not affect outcomes.

Products: The successful production of egg, juvenile, and adult sockeye salmon for supplementation to Stanley Basin waters. The production of future broodstocks.

Objective 2. Maximize genetic diversity within captively-bread sockeye salmon broodstocks.

Hypothesis: Maintaining maximum genetic diversity will reduce inbreeding depression and impacts of hatchery intervention.

Assumptions: Genetically unique captive broodstocks will be identified and maintained separately.

Products: The successful production of isolated, unique broodstocks for future broodstock purposes and for the production of supplementation eggs, progeny and adults.

Objective 3. Determine the efficacy of cryopreservation as a tool for meeting program goals.

Hypothesis: Specific broodstocks can be produced to augment spawn pairings and maximize genetic diversity.

Assumptions: Fertilization rates using cryopreserved milt will be adequate to produce desired broodstocks.

Products: Unique broodstocks to incorporate in spawning matrices. An archive of cryopreserved milt from unique anadromous, residual, and captive male sockeye salmon.

Objective 4. Describe *O. nerka* population characteristics for Stanley Basin lakes in relation to carrying capacity, supplementation efforts and species recovery.

Hypothesis: No testable hypotheses.

Products: Proposed supplementation plans will be reviewed annually in relation to *O. nerka* lake population characteristics and lake carrying capacities.

Objective 5. Determine the contribution hatchery-produced sockeye salmon make toward recovery.

Hypothesis: Overwinter survival and outmigration success of supplementation fish will not differ significantly as a function of broodstock lineage or release strategy.

Assumptions: Rearing history and size at release will be similar among experimental groups. Overwinter survival will be adequate and outmigrant numbers sufficient for evaluation purposes.

Products: Estimated outmigration by broodstock lineage and release strategy for pre-smolt groups released to Stanley Basin lakes. Adaptive program modifications based on relative survival and success differences observed among release strategy groups.

Objective 6. Refine our ability to discern the origin of wild and broodstock *O. nerka* to provide maximum effectiveness in their utilization within the broodstock program.

Hypothesis: Otolith microchemistry can be used to identify environmental life history of wild and broodstock *O. nerka*.

Assumptions: Analytical "finger prints" are unique enough among life history types to produce reliable results.

Products: Base-line data will be generated and used in conjunction with genetic data to identify stocks and specific life history strategies.

Objective 7. Technology Transfer.

Products: Participation in the Technical Oversight Committee process. Preparation of annual reports to satisfy NMFS Permit 795, 823, 844, and 908 reporting requirements under the Endangered Species Act. Preparation of annual reports to satisfy BPA contract requirements.

c. Rationale and significance to Regional Programs.

Rational for the project: Numbers of Snake River sockeye salmon have declined dramatically in recent years. In Idaho, only the lakes of the upper Salmon River (Stanley Basin) remain as potential sources of production. Historically, up to five Stanley Basin lakes supported sockeye salmon. Currently, only Redfish Lake receives a remnant anadromous run. In response to a 1990 petition from the Shoshone-Bannock Tribes to protect Snake River Sockeye Salmon under the Endangered Species Act, NMFS declared the Redfish Lake population "Endangered" in November, 1991. Since 1991, only 15 adult sockeye have returned to Redfish Lake.

IDFG program goals and objectives are consistent with the Council's FWP. In section 7.4D, the Council identifies captive brood stocks as "the most cost effective means of accelerating recovery of severely depleted stocks". In section 7.5A.1, the Council recommends sockeye salmon captive broodstock efforts for funding and lists recommendations including the maintenance of captive broodstocks for the production of supplementation progeny and the development of a program of monitoring and evaluation as the basis for making program improvements. IDFG Captive broodstock program objectives specifically address all "features" of section 7.5A.1 (see Section 4, above, for a review of program objectives and tasks). In many cases, specific broodstock program objectives transcend the Council's FWP. Examples include: the development of "desirable" broodstocks using cryopreserved milt, and the evaluation of outmigrant success by broodstock lineage and release strategy.

Relationships developed to further insure that FWP goals are met include:

Fish culture activities carried out by NMFS at Washington State locations (920400). Eggs produced from anadromous adults at the IDFG Eagle Fish Hatchery are split equally between IDFG and NMFS facilities. Duplicate broodstocks are maintained at both locations to guard against catastrophic loss. Eggs, juveniles, and adults produced at NMFS facilities are transferred to Idaho waters for supplementation. Captive broodstock research conducted at NMFS facilities contributes valuable information to the program.

Habitat investigations of Stanley Basin lakes conducted by the Shoshone-Bannock Tribes (9107100). Base line fishery and limnology data are used to develop whole lake fertilization programs for Redfish, Alturas, and Pettit lakes. Fertilization programs provide "richer" nursery conditions, improve over winter survival and outmigration success, and help stabilize natural production variability.

Genetic investigations of Idaho and regional *O. nerka* populations by the University of Idaho (9009300) and NMFS (8909600). This work was particularly critical between 1991 and 1993 when wild smolts were taken into the program to build future broodstocks. Genetic information continues to be used to identify; indigenous and introduced lake populations, the proportion of residual to resident fish sampled during trawl surveys and sport fisheries, and the origin of returning anadromous adults.

d. Project history

The IDFG initiated captive broodstock and research efforts in 1991. Fish culture responsibilities are shared with NMFS at two Washington State locations. Broodstocks have been established from returning adults (1991, 1992, 1993, 1994, and 1996), wild outmigrants (1991 - 1993, 1995), and residual sockeye salmon (1992, 1993, 1995). Juvenile and adult sockeye salmon produced from captive efforts were first re-introduced to the Stanley Basin in 1994 and 1993, respectively.

The first releases of hatchery-produced juvenile sockeye salmon to Redfish Lake occurred in 1994. Two release strategies were used with four broodstock lineages represented. Prior to planting, all supplementation progeny were adipose fin-clipped and representative numbers injected with PIT tags. Mean fork lengths and weights were recorded during PIT tagging. All juvenile sockeye salmon produced for supplementation in 1994 (14,119) were planted in Redfish Lake as age 0+ pre-smolts. Supplementation fish were produced from brood year 1993 spawning at Eagle Fish Hatchery. The majority of 1994 releases were made to lake net pens in mid-July with the remainder being released directly to the lake in late November. Net pen fish were released to the lake in early August.

In 1995, 95,411 hatchery-produced sockeye salmon (brood year 1994) were planted to Stanley Basin waters over five release strategies. Compared to 1994 efforts, 1995 supplementation incorporated the release of additional pre-smolt lineage groups and release strategies in Redfish Lake, a yearling smolt release to Redfish Lake Creek, and a direct release of age 0+ pre-smolts to Pettit Lake. All supplementation progeny released in 1995 were adipose fin-clipped and representative numbers PIT-tagged as described above. Mean time-of-release fork lengths and weights were recorded as described above.

In 1996, 1,895 age 0+ pre-smolts were planted in Redfish Lake net pens. In addition, 11,545 age 1+ smolts were released directly in Redfish Lake Creek in May. The relatively small number of age 0+ supplementation fish is attributed to the fact that no wild, female sockeye salmon returned to Redfish Lake Creek in 1992. The time-line from spawning to the release of F_2 progeny is typically four years. The release of second generation progeny from 1992 spawning would have occurred in 1996. Age 0+ sockeye salmon released in 1996 were progeny of Redfish Lake residual sockeye salmon and lake outmigrants. Age 1+ smolts were second generation progeny of the four anadromous sockeye salmon that returned to Redfish Lake Creek in 1991. Smolts were produced from broodstock that matured at the NMFS Big Beef Creek facility in Washington State. Rearing occurred at Oregon Department of Fish and Wildlife's Bonneville Fish Hatchery. All age 0+ supplementation progeny released to net pens were adipose fin-clipped and all were PIT-tagged. Age 1+ smolts were right ventral-clipped and coded wire-tagged. Mean time-of-release fork lengths and weights were recorded as described above. In November of 1996, approximately 105,000 eyed-eggs were introduced to incubation boxes in Redfish Lake This was the first year this strategy was employed.

In 1997, brood year 1996 pre-smolts were released to Redfish (156,385), Pettit (8,650), and Alturas (94,914) lakes. Direct lake releases conducted in July and October accounted for 60% of the total number of fish introduced to Redfish Lake. The remaining 40% were released to the lake after three months of net pen rearing. Only direct lake releases were made in Pettit (July) and Alturas (July and October) lakes. In 1997, two broodstock lineages were represented with the majority of fish being second generation progeny of the eight anadromous adult sockeye salmon that returned to Redfish Lake Creek in 1993. All supplementation progeny released in 1997 were adipose fin-clipped with representative numbers PIT-tagged. Mean time-of-release fork lengths and weights were recorded as described above. In November of 1996, approximately 85,000 and 20,000 eyed-eggs were introduced to incubation boxes in Redfish and Alturas lakes, respectively. No smolt releases were made in 1997.

Pre-spawn adult sockeye salmon from the captive broodstock program were first released to Stanley Basin waters in 1993. In that year 20 maturing, adult broodstock sockeye salmon were released to Redfish Lake to naturally spawn. In 1994, 65 maturing adults were released to Redfish Lake. No adults were released in 1995. Telemetry observations identified only one incidence of spwawning related behavior for release years 1993 and 1994. In September of 1996, 120 maturing broodstock adults were released to Redfish Lake. During the course of telemetry investigations, we identified approximately 30 redds near the Sawtooth National Recreation Area Transfer Camp Dock at the south-west end of the lake. In 1997, the adult release program was expanded to include Pettit and Alturas lakes. In that year, 80, 20, and 20 adult sockeye salmon were released to Redfish, Pettit, and Alturas lakes, respectively. Telemetry investigations identified suspected test digs in Alturas Lake and only one well developed redd in Pettit Lake. However, approximately 30 well developed redds were once again observed at the south end of Redfish Lake.

Estimated wild, smolt outmigration from Redfish Lake has ranged from a high of 4,500 fish in 1991 to a low of 357 fish in 1995. In five of the seven years investigated, wild smolt outmigration has been estimated at fewer than 1,000 fish. As no anadromous adults have spawned in Redfish Lake since 1989, wild outmigrants since 1992 are considered progeny of the beach-spawning residual component of the ESU. Hatchery-produced smolts first outmigrated from Redfish Lake in 1995. In that year, we estimated 823 hatchery smolts outmigrated past the juvenile trapping facility on Redfish Lake Creek. In addition, 3,794 age 1+ hatchery-produced smolts, released in Redfish Lake Creek downstream of the weir, contributed to the 1995 outmigration. In 1996 and 1997, 11,836 and 401 hatchery produced outmigrants, respectively, were estimated to have passed the outlet weir. Age 1+ smolts were released to the creek in 1996 (11,545) but not in 1997. Approximately 3,000 hatchery-produced juvenile outmigrants from Pettit Lake contributed to the 1996 outmigration. As no supplementation occurred in Pettit Lake in 1996, no outmigration was observed in 1997.

Fishery and habitat investigations conducted by the Shoshone-Bannock Tribes (9107100) and midwater trawl-based *O. nerka* population estimates developed by IDFG sockeye program research biologists form the foundation for the development of annual supplementation plans. IDFG trawl surveys of Stanley Basin lakes have been conducted since 1990. September estimates of total *O. nerka* population and density in Redfish Lake have increased by over two-fold since 1990. Total September population and density increased from 24,431 fish and 39.7 fish/hectare in 1990 to 55,762 fish and 90.7 fish/hectare in 1997. Alturas Lake has exhibited more variability with respect to *O. nerka* population parameter estimates than any other Stanley Basin lake. Since the inception of Alturas Lake trawl-based population estimates in 1990, population and density estimates have varied greater than twenty-fold. September population and density estimates have ranged from a high of 126,045 fish and 374.7 fish/hectare in 1990 to a low of 5,785 fish and 17.1 fish/hectare in 1994. Fish population numbers, and lake nutrient and food resources are rebuilding slowly in Alturas Lake . Estimated Pettit Lake *O. nerka* population and density climbed from a low of 3,009 fish and 18.8 fish/hectare in 1992 to a high of 71,654 fish and 447.8 fish/hectare in 1996. In 1997, we estimated that fish abundance and density had dropped to 21,730 fish and 135.8 fish/hectare.

Parental lineage investigations using otolith microchemistry have been used to discriminate individual fish from female parents with known and unknown life history. Kokanee and Redfish Lake residual sockeye salmon have been directly linked to fresh water female parents. In addition, we have demonstrated that Redfish Lake residual sockeye salmon are also produced by anadromous female parents. Microchemistry analyses of otoliths form Redfish Lake anadromous sockeye salmon have shown that 3 of the 15 adult sockeye that returned since 1991 were produced by fresh water, residual female parents. In conjunction with genetic analyses of outmigrant sockeye incorporated into the program between 1991 and 1993, otolith microchemistry was used to help discern known anadromous outmigrants from resident kokanee drop-outs.

The Redfish Lake kokanee fishery was closed to harvest in 1993 to protect residual sockeye salmon. In 1995, the kokanee sport fishery was re-opened (recommended by the SBSTOC), as a tool to reduce intra specific competition from resident kokanee. IDFG has monitored the fishery since its re-opening. To date, anglers have removed an estimated 4,365 kokanee.

Reports and technical papers: Captive Broodstock Program Annual Reports to BPA for 1992 through 1996 (DE-B179-91BP21065), 1997 report in press. Research Annual Reports to BPA for 1993 through 1996 appear under separate cover (DE-B179-91BP21065), 1997 report in press.
Flagg, T.A., C.V.W. Manhken, and K.A. Johnson. 1995. Captive broodstocks for recovery of Snake River sockeye salmon. American Fisheries Society Symposium, 15: 81-90.

Siri, P., and K. Johnson. 1995. Maturation and reproduction in salmonid captive breeding programs. Aquaculture, 135: 217-218.

Past costs: 1992- $529,673, 1993- $663,485, 1994- $744,088, 1995- $654,899, 1996- $618,447, 1997- $618,447, 1998- $700,000

e. **Methods**.

Objectives 1, 2, and 3. Fish culture methods used in the captive broodstock program follow accepted, standard practices (for an overview of standard methods see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; Bromage and Roberts 1995; McDaniel et al. 1996; Pennell and Barton 1996). Considerable coordination takes place between NMFS and IDFG culture experts and at the SBSTOC level. Spawning has occurred at Eagle Fish Hatchery each year since the inception of the program in 1991 (Johnson 1992; Johnson 1993; Johnson and Pravecek 1995, Johnson and Pravecek 1996; Pravecek and Johnson 1997). The IDFG is required by NMFS Permit 795 to discuss proposed broodstock spawning matrices prior to conducting activities. Eggs produced at spawning are divided into several lots (by female) and fertilized with sperm from multiple males. Eggs are incubated by lot at different water temperatures to yield lineage-specific size groups for supplementation under different strategies and for future broodstock purposes. Cryopreservation of milt from male donors has been used in the captive broodstock program since 1991 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Beginning in 1996, cryopreserved milt was used to produce specific lineage broodstocks for use in future spawn years. “Designer broodstocks”, produced in this manner, will increase the genetic variability available in future brood years. Critical linkages exist between IDFG and NMFS with respect to the sharing of fish culture responsibilities. Linkages also exist between IDFG, the University of Idaho, and NMFS with respect to genetic monitoring of wild and captive *O. nerka.*

Objective 5. Progeny produced at Eagle Fish Hatchery and at NMFS facilities are supplemented to Stanley Basin waters at different life history stages using a variety of release options including: eyed-egg releases to lake incubator boxes, pre-smolt releases direct to lakes, pre-smolt releases to Redfish Lake following net pen rearing, smolt releases to outlet streams and to the upper Salmon River, and pre-spawn adult releases direct to lakes (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1996).

Outmigrant evaluations are designed to determine whether broodstock lineage or release strategy are critical to the outmigration success of supplementation progeny released to Stanley Basin nursery waters. Adaptively managed, experimental results are incorporated to guide future release plans and ultimately improve program success. To estimate *O. nerka* outmigrant run size from Redfish, Alturas and Pettit lakes, IDFG personnel operate smolt traps on Redfish Lake Creek and on the upper Salmon River at the IDFG Sawtooth Fish Hatchery.

Wild outmigrant sockeye salmon captured at Redfish Lake Creek and Sawtooth FH trap sites are anesthetized in buffered MS222 (Methane Tricaine Sulfonate), measured for fork length, weighed (Redfish Lake Creek only), and injected with PIT tags. Hatchery outmigrants (identified by the absence of adipose fins) captured at the Redfish Lake Creek trap site are anesthetized in this same manner and scanned for PIT tags. PIT-tagged hatchery outmigrants are measured for fork length and weighed as for wild outmigrants. Non-PIT-tagged hatchery outmigrants are enumerated but are not PIT-tagged. All captured sockeye salmon outmigrants are held in flow-through, low velocity live boxes at their respective trap sites and released approximately one-half hour after sunset.

Trapping efficiency is determined by releasing PIT-tagged wild outmigrants upstream for subsequent recapture. Total emigration or outmigration run size is estimated by summing the products of trap efficiency and daily trap catch for specific intervals within the total period of outmigration. Intervals are defined as periods of outmigration with similar stream discharge and recapture efficiency. The variance around trapping efficiency periods is determined using methods for proportional data described in Fleiss (1981).

We evaluate outmigration success by broodstock program release strategy at the Redfish Lake Creek trap, the Pettit Lake Creek trap, and at lower Snake and Columbia river dams with fish bypass and PIT tag detection facilities (Lower Granite, Little Goose, Lower Monumental, and McNary dams). PIT tag interrogation data for mainstem Snake and Columbia river dams is retrieved from the Columbia River Basin PIT Tag Information System (PTAGIS). Median travel times to Lower Granite Dam are calculated (where possible) for wild and hatchery-produced sockeye salmon. Because systems operations and fish handling potentially differ by date, arrival times to Lower Granite Dam are compared for wild and hatchery-produced progeny (by release strategy) using two sample Kolmogorov-Smirnov tests (α=.05), (Sokal and Rohlf 1981). Multiple, chi!square goodness of fit tests are used to compare PIT tag interrogation data for both the Redfish Lake trap and mainstem dam locations (Zar 1974). A priori power analysis for chi-square tests is conducted to determine PIT tag sample size (Cohen 1989). By establishing hypothetical over-winter survival rates and outmigration estimates and by applying a minimum estimate of cumulative, unique interrogation at mainstem Columbia and Snake river dams, we were able to develop an estimate of the number of PIT tag detections we should see for any one release lineage or release strategy. This allows us to establish a series of hypothetical detection proportions between test groups and compute different effect sizes to determine the total number of unique dam detections required to yield 0.80 power at the 0.05 significance level. Critical linkages exist with downstream PIT tag interrogation and data base programs and with limnology investigations and whole lake fertilization programs conducted by the Shoshone-Bannock Tribes..

Adult sockeye salmon released to Stanley Basin lakes for volitional spawning are tracked using ultrasonic telemetry equipment to document movement patterns and identify spawning-related behavior. Telemetry investigations also allow us to identify the incidence of over winter survival for adults released the previous year.

Objective 4. To estimate *O. nerka* population, density, and biomass, we conduct midwater trawling at night during the dark (new) phase of the moon. Trawling is performed in a stepped-oblique fashion as described by Rieman (1992) and Kline (1994). We estimate total *O. nerka* population, density, and biomass using the TRAWL.WK1 developed by Rieman (1992). Population, density, and biomass estimates generated by this program are extrapolations of actual trawl catch data to the total area of the lake mid-depth in the observed sockeye salmon stratum. Whenever possible, we estimated population and density by individual age-class (assuming representation in the trawl).

We record fork length and weight for all trawl-captured *O. nerka*. Sagittal otoliths are removed from all fish, cleaned, and stored dry in microcentrifuge tubes. All otoliths are surface-aged otoliths under transmitted and/or reflected light with the aid of a variable power dissecting microscope. Tissue samples are collected and preserved for genetic analysis by NMFS and University of Idaho technicians. Stomachs are removed and preserved for diet analysis by Shoshone- Bannock Tribe biologists (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1996).

Objective 6. We use otolith microchemistry to improve our knowledge of the parental lineage of wild and broodstock sockeye salmon and kokanee. The preparation of otoliths for microchemistry analysis follows procedures developed by Kalish (1990) and Rieman et al. (1993). Sample preparations are analyzed at Oregon State University (College of

Oceanography, Corvallis, OR 97331-5503) and follow procedures outlined by Toole and Nielsen (1992). Microprobe transects are run in otolith nuclei adjacent to the primordia of all samples (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1996).

Objective 4. To provide information on the potential impact of harvest-oriented sport fisheries in sockeye salmon nursery lakes, we conduct roving creel surveys on Redfish and Pettit lakes (Kline and Lamansky 1996). Creel surveys are stratified by 14 day interval, weekday and weekend day types, and morning (06:00 to 16:00) and evening (16:00 to 20:00) day periods. Two weekday and one weekend day are surveyed each week of the census. On each survey date, two instantaneous counts are made (one in each day period). We select angler count dates randomly and count times systematically. Angler counts are made by boat. Creel personnel count the number of boats fishing and the number of bank anglers fishing. Boat counts are adjusted based on the number of anglers per boat determined from interviews. Angler interviews are conducted on count dates following the completion of each instantaneous count. We record number of anglers, hours fished, and gear type. We ask anglers how many fish they have harvested and/or released by species. Adipose fins are removed from all creeled kokanee and stored in 70% ethanol for mitochondrial DNA analysis by University of Idaho personnel. Hatchery rainbow trout (Pettit Lake only) fin marks are identified to document over winter survival. Creel data are analyzed using the Creel Census System program developed by McArthur (1992).

f. **Facilities and equipment**.

Eagle Fish Hatchery is the primary Idaho site for the sockeye captive broodstock program. Artesian water from five wells is currently in use. Artesian flow is augmented through the use of four separate pump/motor systems. Water temperature remains a constant 13.3^{o}C and total dissolved gas averages 100% after degassing. Water chilling capability was added at Eagle Hatchery in 1993. Chiller capacity accommodates incubation, a portion of fry rearing and a portion of adult holding needs. Backup and system redundancy is in place for degassing, pumping, and power generation. Nine water level alarms are in use and linked through an emergency service operator. Additional security is provided by limiting public access and by the presence of three on-site residences occupied by IDFG hatchery personnel.

Facility layout at Eagle Hatchery remains flexible to accommodate culture activities ranging from spawning and incubation through adult rearing. Egg incubation capacity at Eagle Hatchery is approximately 180,000 eggs. Incubation is accomplished in small containers specifically designed for the program. Incubators are designed to distribute both up welling and down welling flow to accommodate pre and post-hatch stages.

Several fiberglass tank sizes are used to culture sockeye from fry to the adult stage including: 1) 0.7 m diameter semi-square tanks (0.91 m^3), 2) 1 m diameter semi-square tanks (0.30 m^3), 3) 2 m diameter semi-square tanks (1.42 m^3), 4) 3 m diameter circular tanks (6.50 m^3), and 5) 4 m diameter semi-square tanks (8.89 m^3). Typically, 0.7 m and 1 m tanks are used for rearing fry from ponding to approximately 1 g weight. Two and three meter tanks are used to rear juveniles to approximately 10 g and to depot and group fish by lineage or release strategy prior to distribution to Stanley Basin waters. Three and four meter tanks are used to rear fish to maturity for future broodstock production (spawning). Flows to all tanks are maintained at no less than 1.5 exchanges per hour. Shade covering (70%) and jump screens are used where appropriate. Discharge standpipes are external on all tanks assembled in two sections ("half pipe principal") to prevent tank dewatering during tank cleaning.

Sawtooth Hatchery was completed in 1985 as part of the Lower Snake River Compensation Plan and is located on the Salmon river 3.5 km upstream from the confluence of Redfish Lake Creek. Sawtooth Hatchery personnel and facilities have been used continuously since 1991 for various aspects of the sockeye captive broodstock program including: 1) pre-spawn anadromous adult holding, 2) egg incubation, and 3) juvenile rearing for pre-smolt and smolt releases. In addition, hatchery personnel assist with many field activities covered by this permit including: 1) net pen fish rearing, 2) fish trapping and handling, and 3) fish transportation and release.

Eyed-eggs, received at Sawtooth Hatchery from Eagle Hatchery or NMFS, are incubated in Heath trays. Fry are ponded to 0.7 m fiberglass tanks as described above. Juvenile sockeye (>1 g) are held in vats or in a series of 2 m fiberglass tanks installed in 1997. Typically, juvenile sockeye salmon reared at Sawtooth Hatchery are released as sub-yearlings or yearlings. Pre-spawn anadromous adults captured at Redfish Lake Creek or Sawtooth Hatchery weirs are held in vats until their transfer to the Eagle Hatchery for spawning. All incubation, rearing and holding occurs on well water. Water temperature varies by time of year from approximately 2.5EC in January/February to 11.1EC in August/September. Back-up and redundancy systems are in place. Rearing protocols are established cooperatively between IDFG personnel and reviewed at the SBSTOC level.

Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration will be used for the task at hand. Fish are maintained in water of the proper quality (temperature, oxygen, chemical composition) as much as is possible during handling and transfer phases of transportation. Containers will vary from five-gallon plastic buckets and coolers for short term holding and inventory needs to very sophisticated truck-mounted tanks for long distance (or duration) transfers. Truck mounted tanks with capacities of 300 gal. (1,136 L), 1000 gal. (3,785 L), and 2,500 gal. (9,463 L) are available to the program.

Monitoring and evaluation equipment includes; a trawl boat used for lake population investigations, two skiffs used for net pen, egg release, and telemetry surveys, a permanent weir footing and associated equipment used for outmigrant and adult trapping on Redfish Lake Creek, one PIT tag station and several back-up readers and antennas, one camp trailer for field personnel, telemetry tracking gear, cryopreservation equipment, SCUBA equipment used for net pen maintenance, and many other miscellaneous pieces of equipment necessary for completion of identified tasks. Computer equipment includes two desktop units and five laptop units for office and field activities (laptops used primarily for PIT tagging). Four vehicles are assigned to the project with additional IDFG vehicles available as needed (fish transportation). Immediate project personnel are located at two locations; the Eagle Fish Hatchery and the Nampa Fisheries Research Office. Adequate office and storage space is available. The IDFG Fish Health Laboratory is located adjacent to the Eagle Fish Hatchery and provides space for all necropsy work associated with the program. Pathology investigations are carried out, as needed, at this location.

g. References.

Bjornn, T.C., D.R. Craddock, and D.R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, Oncorhynchus nerka. Transactions of the American Fisheries Society, 97:360-373.

Bromage, N. R. and R. J. Roberts. 1995. Broodstock Management and Egg and Larval Quality. Blackwell Science Ltd. Cambridge, MA.

Chapman, D.W., W.S. Platts, D. Park, and M. Hill. 1990. Status of Snake River sockeye salmon. Don Chapman Consultants, Inc., Boise, ID.

Cloud, J.G., Miller, W. H. and M.J. Levenduski. 1990. Cryopreservation of sperm as a means to store salmonid germ plasm and to transfer genes from wild fish to hatchery populations. The Progressive Fish Culturist 52:51-53.

Cohen, J. 1989. Statistical power analysis for the behavioral sciences, 2nd ed. Lawrence Erlbaum Associates, Hillsdale, N.J.

Erdahl, D. A. 1994. Inland Salmonid Broodstock Management Handbook. United States Department of the Interior Fish and Wildlife Service. 712 FW 1.

Everman, B.W. 1895. A preliminary report upon salmon investigations in Idaho in 1894. Bulletin of the United States Fisheries Commission, 15:253-284.

Flagg, T.A., C.V.W. Mahnken, and K. A. Johnson. 1995. Captive broodstocks for recovery of Snake River sockeye salmon. American Fisheries Society Symposium 15:81-90.

Fleiss, J.L. 1981. Statistical methods for rates and proportions, 2nd ed. Wiley and Sons, New York, NY.

Hard, J.J., R.P. Jones, M.R. Delarm, and R.S. Waples. 1992. Pacific salmon and artificial propagation under the Endangered Species Act. NOAA (National

Oceanic and Atmospheric Admisistration) Technical Memorandum NMFS (National Marine Fisheries Service) NSFSC-2.

Johnson, K. 1992. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-B179-91BP21065. Portland, OR.

Johnson, K. 1993. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-B179-91BP21065. Portland, OR.

Johnson, K. and J. Pravecek. 1995. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-B179-91BP21065. Portland, OR.

Johnson, K. and J. Pravecek. 1996. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-B179-91BP21065. Portland, OR.

Kalish, J.M. 1990. Use of otolith microchemistry to distinguish the progeny of sympatric anadromous and non-anadromous salmonids. Fishery Bulletin, 88: 657-666.

Kline, P.A. 1994. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-BI79-91BP21065. Portland, OR.

Kline, P.A., and J. Younk. 1995. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-BI79-91BP21065. Portland, OR.

Leitritz, E. And R.C. Lewis. 1976. Trout and salmon culture (hatchery methods). California Department of Fish and Game Fish Bulletin 164.

McArthur, T. 1992. Statewide angler opinion and harvest surveys, creel census system. Idaho Department of Fish and Game, Job Performance Report, Project No. F-71-R-14, Subproject 1, Study 1. Boise, ID

McDaniel, T.R., K.M. Prett, T.R. Meyers, T.D. Ellison, J.E. Follett, and J.A. Burke. 1994. Alaska Sockeye Salmon Culture Manual. Special Fisheries Report No. 6. Alaska Department of Fish and Game, Juneau.

Pennell, W. and B.A. Barton. 1996. Principles of Salmonid Aquaculture. Elsevier Science B.V. Amsterdam, The Netherlands.

Piper, G. R., I. B. McElwain, L.E. Orme, J. P. McCraren, L. G. Gowler, and J. R. Leonard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service, Washington, D.C.

Pravecek, J. and K. Johnson. 1997. Research and recovery of Snake River sockeye salmon. Idaho Department of Fish and Game. Annual Report to U.S. DOE, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 91-72, Contract No. DE-B179-91BP21065. Portland, OR.

Rieman, B.E. 1992. Kokanee salmon population dynamics - kokanee salmon monitoring guidelines. Idaho Department of Fish and Game, Project No. F-73-R-14, Subproject II, Study II. Boise, ID.

Rieman, B.E., D.L. Myers, and R.L. Nielsen. 1993. The use of otolith microchemistry to discriminate <u>Oncorhynchus</u> <u>nerka</u> of resident and anadromous origin. Idaho Department of Fish and Game. Boise, ID.

Sokal, R.R., and F.J. Rohlf. 1981. Biometry, 2nd ed. W.H. Freeman and Company, New York, NY.

Toole, C.L., and R.L. Nielsen. 1992. Effects of microprobe presicion on hypotheses related to otolith Sr:Ca ratios. Fishery Bulletin 41:239-255.

Waples, R.S. 1991. Definition of species under the Endangered Species Act: application to Pacific salmon. NOAA (National Oceanic and Atmospheric Administration) Technical Memorandum NMFS (National Marine Fisheries Service F/NWC-194.

Wheeler, P. A. , and G. A. Thorgaard. 1991. Cryopreservation of rainbow trout semen in large straws. Aquaculture 93:95-100.

Zar, J.H. 1974. Biostatistical Analysis. 1974. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Section 8. Relationships to other projects

Fish culture activities carried out by NMFS at Washington State locations (920400) are an integral component of the program. Eggs produced from anadromous adults at the IDFG Eagle Fish Hatchery are split equally between IDFG and NMFS facilities. Duplicate broodstocks are maintained at both locations to guard against catastrophic loss. Eggs, juveniles, and adults produced at NMFS facilities are transferred to Idaho waters for supplementation. Captive broodstock research conducted at NMFS facilities contributes valuable information to the program.

Habitat investigations of Stanley Basin lakes conducted by the Shoshone-Bannock Tribes (9107100) provide the foundation from which supplementation efforts are based. Base line fishery and limnology data are used to develop whole lake fertilization programs for Redfish, Alturas, and Pettit lakes. Fertilization programs provide "richer" nursery conditions, improve over winter survival and outmigration success, and help stabilize natural production variability.

Genetic investigations of Idaho and regional O. nerka populations by the University of Idaho (9009300) and NMFS (8909600) provide information essential to the development of anadromous, not resident, broodstocks. This was particularly critical between 1991 and 1993 when wild smolts were taken to the program to build future broodstocks. Genetic information continues to be used to identify; indigenous and introduced lake populations, the proportion of residual to resident fish sampled during trawl surveys and sport fisheries, and the origin of returning anadromous adults.

IDFG fish propagation activities associated with the sockeye captive broodstock program and the chinook salmon captive rearing program (9700100) are conducted at the Eagle Fish Hatchery. Although managed as separate projects, program responsibilities overlap and complement each other.

Section 9. Key personnel

The principal investigator on this project is Paul Kline. Mr. Kline has worked for IDFG since 1992 in resident and anadromous fisheries research sub-sections. He has been affiliated with sockeye salmon recovery efforts since 1993. Prior to assuming the position of principal investigator, Mr. Kline served as sockeye project research biologist. He received a B.S. and M.S. in Natural Resources and Fisheries from Humboldt State University (1975, 1980). Prior to coming to IDFG, Mr. Kline worked for the United States Forest Service and for a private consulting firm in Northern California. As a consultant, Mr. Kline was involved with habitat and population surveys of coastal chinook and coho salmon and steelhead.

The research biologist on the project is Jay Pravecek. Mr. Pravecek has worked for IDFG within the sockeye program since 1994. Prior to assuming the research biologist position in 1997, he served as fish culturist on the project. He received a B.S. in Biology from Black Hills State University in 1991 and an M.S. in Fish and Wildlife Management from Montana State University in 1995. Prior to coming to IDFG, Mr. Pravecek worked for South Dakota Game, Fish, and Parks, U.S Fish and Wildlife Service, and Montana State University. Work conducted before coming to IDFG involved fish culture and fisheries research.

The assistant hatchery manager on the project is Brian Malaise. Mr Malaise has worked for the IDFG since 1990 at several resident and anadromous hatcheries throughout the state. He has been associated with the sockeye program since 1996. Mr. Malaise received a B.S. in Fisheries and Wildlife Biology from Iowa State University in 1990. Prior to coming to IDFG, Mr Malaise worked for the Iowa Department of Natural

Resources.

Section 10. Information/technology transfer

Considerable local attention is drawn to project activities in the Stanley Basin of Idaho. Project cooperators strive to maintain an up-to-date awareness at this local level. IDFG Sawtooth Hatchery personnel, Salmon Region personnel, and immediate project personnel make public contacts on a regular basis to discuss project-related issues. IDFG information and education and enforcement personnel address different audiences several times each year to distribute project-related information. Idaho and regional news media interview project cooperators frequently contributing to the publics' awareness of regional salmon issues.

Project cooperators meet monthly (SBSTOC) to discuss findings and review planned activities. BPA chairs this process and develops concise meeting minutes that are available to the public. Annual reports of program activities a written and are available from the BPA library. Annual reports of program activities required by Section 10 of the Endangered Species Act are also prepared. Presentations are made at regional fish culture and fish health conferences and at meetings held by the Idaho Chapter of the American Fisheries Society.